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Elephants in India: A Comprehensive Zoological Study Based on Distribution, Captivity, Conservation and Protection

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Abstract
India harbors the largest population of wild Asian elephants, estimated at approximately 26,000 to 28,000 individuals, which constitutes nearly 60% of the species' global population. Elephas maximus is classified under Schedule I and Part I of the Indian Wildlife Protection Act (1972), granting it the highest level of legal protection. The elephant holds significant cultural and mythological importance in India's heritage, alongside historical roles in the economy and military, fostering strong public support for its conservation and survival. However, the challenges posed by a burgeoning human population, rapid economic growth, expanding and migrating elephant populations at regional levels, habitat loss and fragmentation, and escalating human-elephant conflicts underscore the critical need for effective long-term policies to manage and safeguard this species.

Keywords: Wild elephant, zoology, conservation, wildlife protection, habitat loss, fragmentation, population.

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Introduction
India, with a longstanding tradition of approximately 4500 years in elephant husbandry, currently oversees a captive population of 3400-3600 elephants. These elephants have historically been utilized in various capacities in India, such as for warfare, logging, cultural and religious ceremonies, as well as for recreation in zoos and circuses. More recently, they are employed in wildlife tourism and for safeguarding sanctuaries and national parks. However, the demand for captive elephants has dwindled due to the decline in logging activities following a ban and the adoption of modern machinery. This shift has led to reduced interest among private owners and state forest departments in maintaining captive elephants. Conversely, there is a growing demand for elephants in temples, which traditionally sourced their elephants from state forest departments. However, temple stocks are declining due to natural deaths from old age and a lack of new recruits through breeding.

Distribution of Wild Elephants
Today, elephants in India inhabit only a small fraction (approximately 3.5%) of their former range, which once spanned from south of the Himalayas to cover nearly the entire subcontinent, excluding the most arid regions, around six thousand years ago. The ancient text Kautilya Arthasastra (circa 300 BCE – 300 CE) documents the presence of elephants in eight gajavanas or elephant forests north of the Krishna River, including regions like Saurashtra, where they are now extinct. Historical accounts from the memoirs and writings of Mughal emperors in the 16th and 17th centuries provide insights into the distribution of elephants in central India, indicating their past presence from southern Uttar Pradesh through Madhya Pradesh and Chhattisgarh, although they disappeared from some areas (though elephants have since returned to Chhattisgarh). By the late 19th century, the expansion of agriculture and human settlements had significantly reduced their habitat to forests at the foothills of the Himalayas, east-central India, and southern India. Although the exact number of wild elephants in historical times remains uncertain, records such as those of the French navigator Pyrard de Laval from the early 17th century under Emperor Jahangir suggest a total population of around 40,000 elephants (potentially including both captive and wild) within the territories of the Mughal Empire and Bengal.

Present-Day Status
Wild elephants in India currently inhabit forested hilly regions across four distinct areas: (i) the foothills of the Himalayas in the north, (ii) the northeastern states, (iii) the forests of east-central India, and (iv) the forested hilly tracts of the Western and Eastern Ghats in southern India. Additionally, a small population of feral elephants exists in the Andaman Islands. Here is a summary of the status and distribution of elephants in these major regions of India:

- Northeastern India: Elephants in this region are distributed along the Himalayan foothills from northern West Bengal to Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, and Meghalaya. The estimated population is approximately 9000-9500 elephants, spread across 32,600 km2. The region is divided into multiple sub-populations, with significant populations remaining in specific areas such as North Bank of the Brahmaputra in Assam and Arunachal Pradesh (3250 elephants), South

Bank—Eastern Areas in Assam and Arunachal (1200 elephants), South Bank—Central Areas of Kaziranga-Karbi Anglong-Nagaland (2950 elephants), and South Bank—Western Areas of Assam extending into Meghalaya (3000 elephants). Habitat loss due to logging, shifting cultivation, monoculture plantations, and encroachments poses serious threats to elephant conservation in this region.

- Northern India: The elephant range extends west-east along the foothill forests and floodplains of the Himalayas in Uttarakhand and Uttar Pradesh, bordering Nepal. The region supports approximately 1700 elephants, with increasing numbers observed over recent years. Important elephant habitats include Rajaji and Corbett National Parks and Lansdowne Forest Division. Historical habitat continuity along the terai-bhabbar tract from the river Yamuna to the river Sharda has been fragmented due to post-independence developmental projects and human settlements.
- East-central India: Elephants in eastern India primarily inhabit the Chota Nagpur plateau, spanning across Orissa and parts of Jharkhand, with some movements observed into neighboring states like southern West Bengal, Chhattisgarh, and northeastern Andhra Pradesh. The population is estimated around 2650 elephants, with significant populations in Orissa (1860 elephants), Jharkhand (624 elephants), Chhattisgarh (122 elephants), and southern West Bengal (25 resident elephants). Mining activities for minerals such as iron, manganese, and chromate pose the largest threat to elephant conservation in this region.
- Southern India: Southern India's elephants are found in forested hilly tracts of the Western Ghats and adjacent Eastern Ghats in Karnataka, Kerala, Tamil Nadu, and recently in parts of Andhra Pradesh, Maharashtra, and Goa. The current distribution is restricted within the Ghats due to increasing human population, agriculture expansion, commercial plantations, and infrastructure development. Key landscapes include Uttara Kannada, Bhadra Wildlife Sanctuary, Brahmagiri–Nilgiri–Wyanad–Mysore, Anamalai–Nelliyampathy–High Ranges, and Periyar–Agasthyamalai, collectively supporting over 14,000 elephants. Protected Areas cover a significant portion of their habitat, contributing to conservation efforts.
- Island Population: The Andaman and Nicobar Islands harbor a population of 40 feral elephants in the Diglipur Forest Division in North Andaman and the Interview Island Sanctuary. These elephants were originally brought from the mainland for timber extraction and left behind when operations ceased in 1962.

These regional populations highlight the challenges and conservation efforts needed to protect elephants in India amidst habitat fragmentation, human-elephant conflicts, and increasing developmental pressures.

Challenges to Conservation

Habitat loss and the increasing risk of habitat fragmentation pose significant threats to elephant conservation in India. Many of the vital corridors that elephants rely on are under threat due to rapid economic growth, leading to activities such as the construction of new roads and railway lines, expansion of existing infrastructure (particularly noticeable in the northeast and around Corbett National Park in the north), tourism development, mining activities in regions like Keonjhar and Saranda districts in east-central India, and the demand for large dams in the south. For instance, over a five-year period from 2006 to 2011, approximately 44 elephants were killed in collisions with trains across the country. The fragmentation, loss, and degradation of elephant habitats, coupled with increasing elephant populations in some areas and the cessation of elephant captures, have exacerbated human-elephant conflicts. These conflicts often result in human fatalities, damage to crops, and property destruction. Furthermore, the dispersal of elephant groups since the early 1980s in various regions has intensified conflicts between elephants and communities unaccustomed to living alongside them for many decades or centuries.

Between 1998 and 2001, there were 900 recorded human deaths due to elephant attacks in India, averaging between 250 to 300 deaths annually, a number that has risen to over 400 deaths per year by 2010. In response to these conflicts, the government allocates a significant portion of its conservation budget to compensatory payments (ex-gratia payments) to affected individuals. Despite these measures, some communities resort to retaliatory measures against raiding elephants, such as poisoning or electrocuting them, resulting in the deaths of at least 200 elephants between 2006 and 2011. Additionally, illegal captures of wild elephant calves for the captive elephant trade occur in some areas along the Assam-Arunachal and Assam-Nagaland borders in the northeast. Ivory poaching remains a critical threat to elephant conservation in India, particularly affecting tusked male elephants.

This issue became particularly severe in southern India during the 1970s, intensifying through the 1980s and 1990s, leading to highly skewed sex ratios among adult elephants. For example, in Periyar Tiger Reserve, the adult male to female ratio was as skewed as 1:100 by the 1990s, improving slightly to about 1:60 by 2005. Ivory poaching also impacts sub-adult and juvenile sex ratios in many southern populations. Over the past decade, ivory poaching has been prominently observed in the east-central state of Orissa, although the full extent and impact of this activity have not been fully assessed.

Management and Mitigation Strategies

Although state forest departments previously managed conflicts between elephants and humans using methods like barriers, captures, and drives, the initiation of Project Elephant by the Indian government in 1991-92 significantly bolstered resources and action plans

to tackle this issue. Compensatory payments have been crucial in providing compensation to individuals who have suffered losses due to elephant damage and attacks on crops, property, or lives. State forest departments have actively deployed barriers along the boundaries between forests and agriculture to prevent elephants from venturing into cultivated areas. However, barriers like ditches or trenches have shown limited effectiveness, particularly in regions with high rainfall.

Combining these with high-voltage electric fences has proven more successful in dry areas with firm soil, although maintenance challenges often undermine their effectiveness. Electric fences are widely used across the country but encounter issues with maintenance, which affects their reliability. In cases where fences are privately managed or involve local communities in maintenance, success rates are typically higher. In West Bengal, anti-depredation squads equipped with vehicles, lights, and firearms have been somewhat successful in driving elephants away from paddy fields and tea plantations in the northern regions, though success is not guaranteed. Southern Indian states have effectively engaged tribal populations to combat ivory poaching within and outside protected areas, using these anti-poaching squads for additional tasks such as managing crop-raiding elephants and fire prevention. The increasing dispersal of elephant herds and solitary bulls into new habitats presents new challenges for management.

States have experimented with elephant drives (such as those in Tamil Nadu in the 1980s) and capturing elephants, with some bulls being maintained in captivity in Karnataka since approximately 1987. However, attempts at relocation have often failed, as exemplified by unsuccessful efforts to relocate two bull elephants captured in Hassan district to Bandipur in Karnataka, a distance exceeding 150 km. Occasionally, "rogue" elephants, typically solitary bulls responsible for multiple human fatalities or rampages, have been culled as a measure of control. Project Elephant introduced landscape-level planning for the conservation and management of elephants, emphasizing the protection and enhancement of elephant corridors. Some success has been achieved in strengthening these corridors, particularly in Karnataka and Kerala, with assistance from non-governmental organizations. However, more comprehensive integrated land use and developmental planning at the landscape level, sensitive to local social and economic factors, is essential for the long-term conservation of elephants. Recognizing this need, a second task force appointed by the Indian government delved deeper into these issues in 2010.

Captivity

In ancient times, captive elephants numbered in the thousands, primarily used in the armies of rulers across the subcontinent. Historical records highlight peaks in the management of captive elephants, particularly during the Mauryan period in the 3rd century BC and the Mughal period in the early 17th century, when large numbers were captured for warfare purposes. For instance, between 1868 and 1980, records indicate that 30,000–50,000 wild elephants were captured, especially in northeastern India. Official estimates today place the number of captive elephants between 3467 and 3667 animals. The decline in the number of captive elephants can be attributed to several factors, including the modernization of forestry operations with the introduction of machinery, changes in lifestyle leading to the redundancy of elephants, legal prohibitions on capturing wild elephants, and limited employment opportunities due to the high cost of maintenance.

Captive elephants in India are categorized based on ownership (government-owned or private) and the primary role they play. These categories include circus elephants (owned by private entities and used for performances), forest camp elephants (government-owned, kept near forest areas), privately owned elephants (used for various purposes or as companions), travel-begging elephants (owned by private individuals or institutions, used mainly for street begging), temple elephants (owned by religious institutions or private organizations), and zoo elephants (owned by the government, housed in zoos with or without work duties). The management practices for captive elephants vary significantly. Forest camp elephants typically reside in natural habitats, where they have some freedom to roam and access to water bodies, supplemented with a diet that includes natural forage and cooked grains (as observed in Tamil Nadu). In contrast, some privately owned elephants in states like Assam and Kerala may be kept on natural or artificial flooring, receiving stall-fed diets and occasionally walking on asphalted roads for extended periods. Elephants in zoos and circuses are usually confined to restricted spaces with a mix of hard and natural flooring and provided with permanent or temporary shelters. Temple elephants are generally housed within temple premises, where they are stall-fed and confined to shelters. All captive elephants are subject to some form of restraint, such as ropes or chains. Veterinary care tends to be more comprehensive in government-owned forest camps and zoos compared to other facilities. Interaction between captive and wild elephants is primarily feasible in forest camp settings where captive elephants roam freely in natural environments. Forest camp elephants often engage in social interactions, including breeding between wild bulls and captive cows, leading to offspring that exhibit social bonds similar to those observed among wild elephants.

In Conclusion

The primary activities of captive elephants vary depending on their management context. Elephants in forest camps are typically engaged in patrolling, tourist rides, conflict mitigation operations as "koonkies," and various forestry-related tasks. Private individuals or institutions that own elephants often employ them in religious or celebratory functions, tourist rides, and timber-related work. Some privately owned elephants are also used for begging in public or hired for weddings and other festivities. Temple elephants, aside

from participating in temple rituals and processions, are usually tethered within temple premises where they bless the public and perform ceremonial duties. In zoos, elephants are utilized for tourist rides, fodder collection, and other designated activities, while circus elephants entertain audiences with performances. Presently, legal capture of wild elephants is extremely rare, except for isolated incidents reported primarily in northeastern Indian states. Such captures are typically undertaken as a last resort to mitigate human-elephant conflict.

According to a comprehensive study involving nearly 800 captive elephants conducted jointly by the Asian Nature Conservation Foundation and Compassion Unlimited Plus Action, approximately 21% of these elephants were born in captivity. Breeding rates are notably high in forest camps and zoos nationwide, with some breeding also occurring among elephants owned by private individuals or institutions, as well as temple-owned elephants. Under Indian law, owning an ownership certificate is mandatory for all captive elephants, and the introduction of microchipping has streamlined this process. A survey covering 1545 elephants across 13 states and under 6 different management regimes indicated that 44% of captive elephants possess ownership certificates, while 48% have been implanted with microchips.

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